Non−Linear IR Corrections

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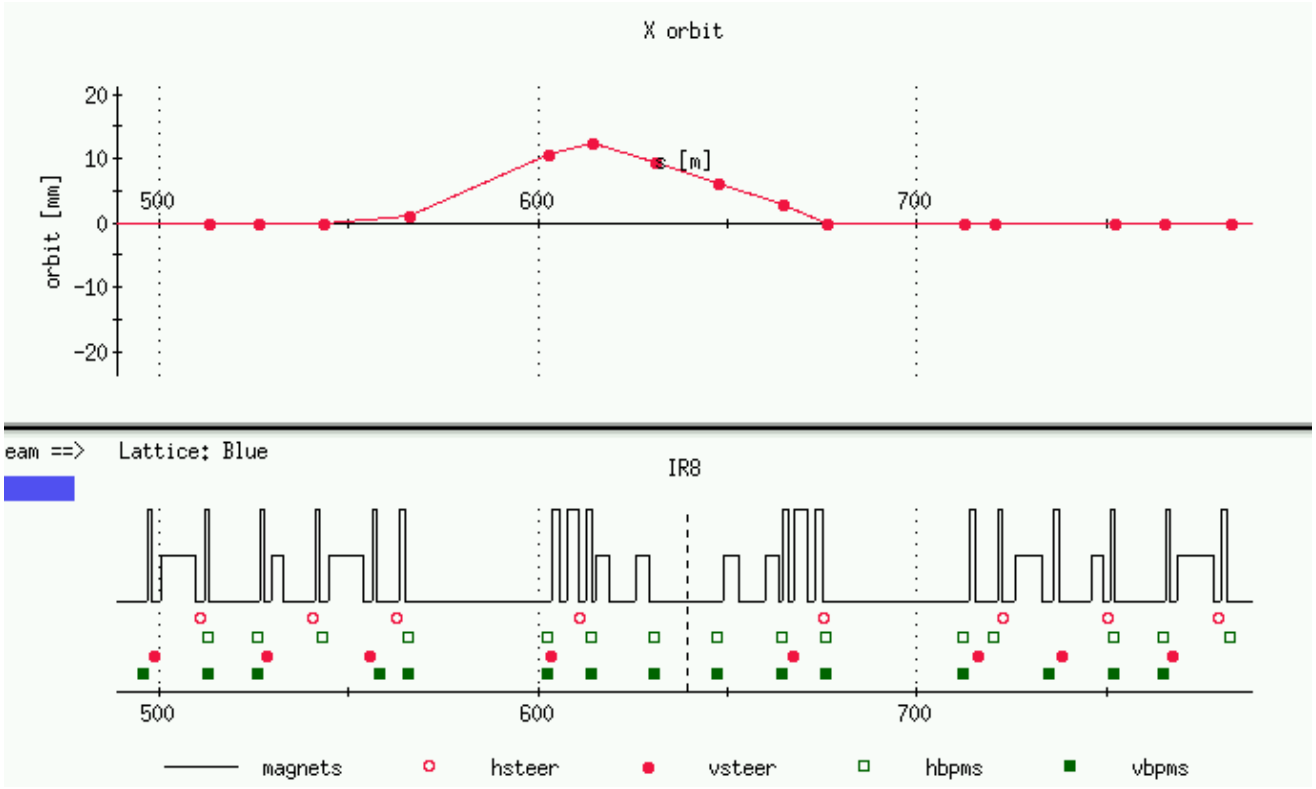
IR Local Corrections

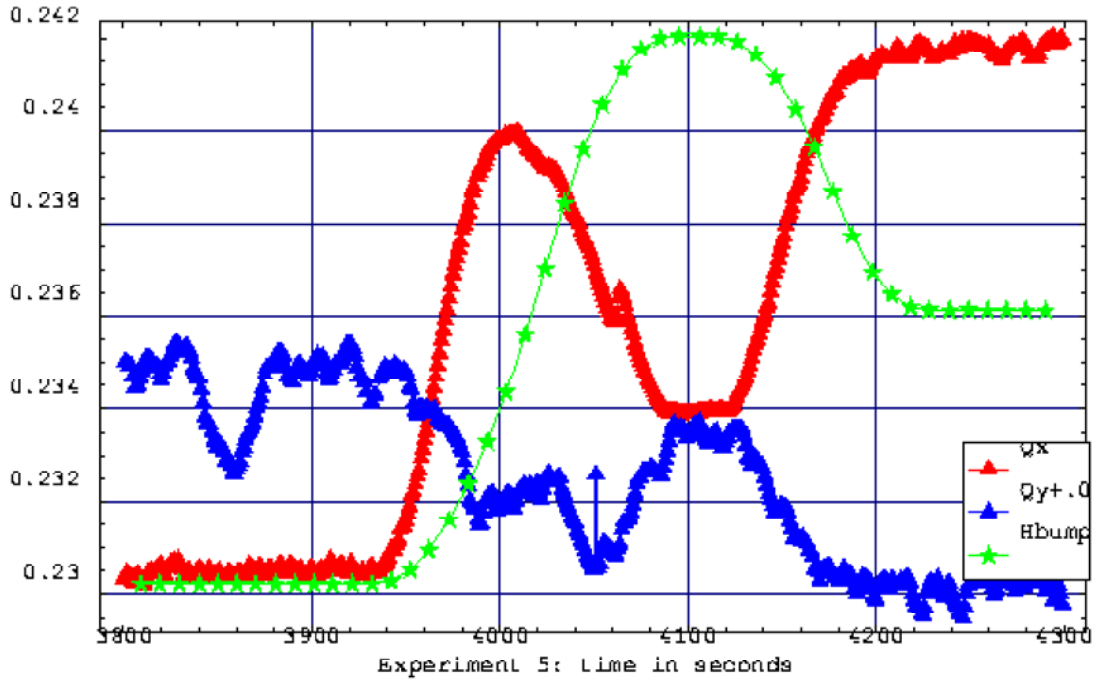
- Method involves:
  - Local orbit bumps at IR triplets
    - Based on 3−correctors
    - Up to 25mm at injection and 15mm at flattop
  - Betatron tune shift measurement by PLL,Schottky,ARTUS
  - Extraction of the values for nonlinear corrector strengths and/or
  - Correction eliminating the tune shift versus bump amplitude dependence

An example of IR triplet closed orbit bump used as a tool for the studies



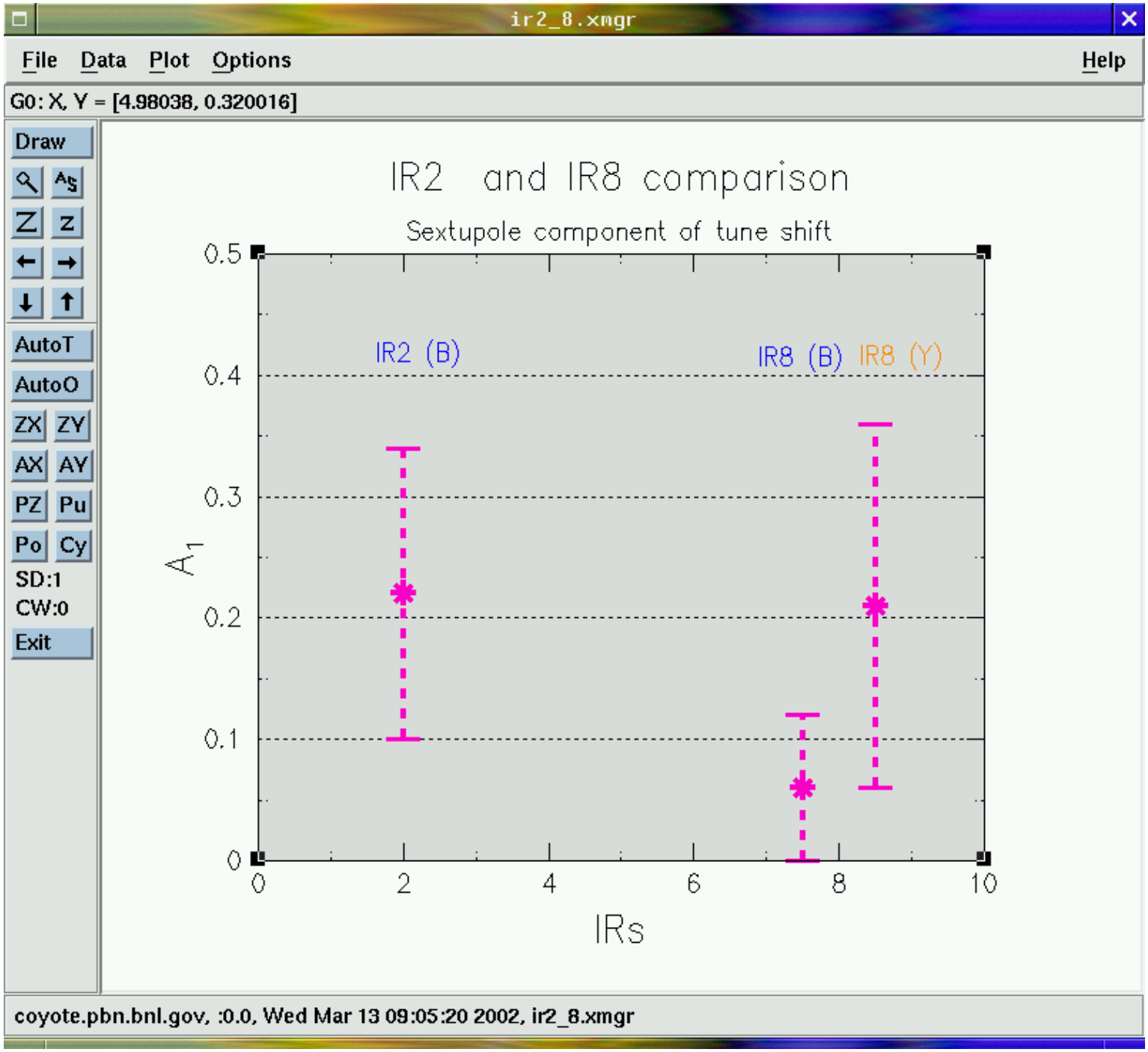
The orbit bump is changing (green curve) and the PLL tune data is being followed

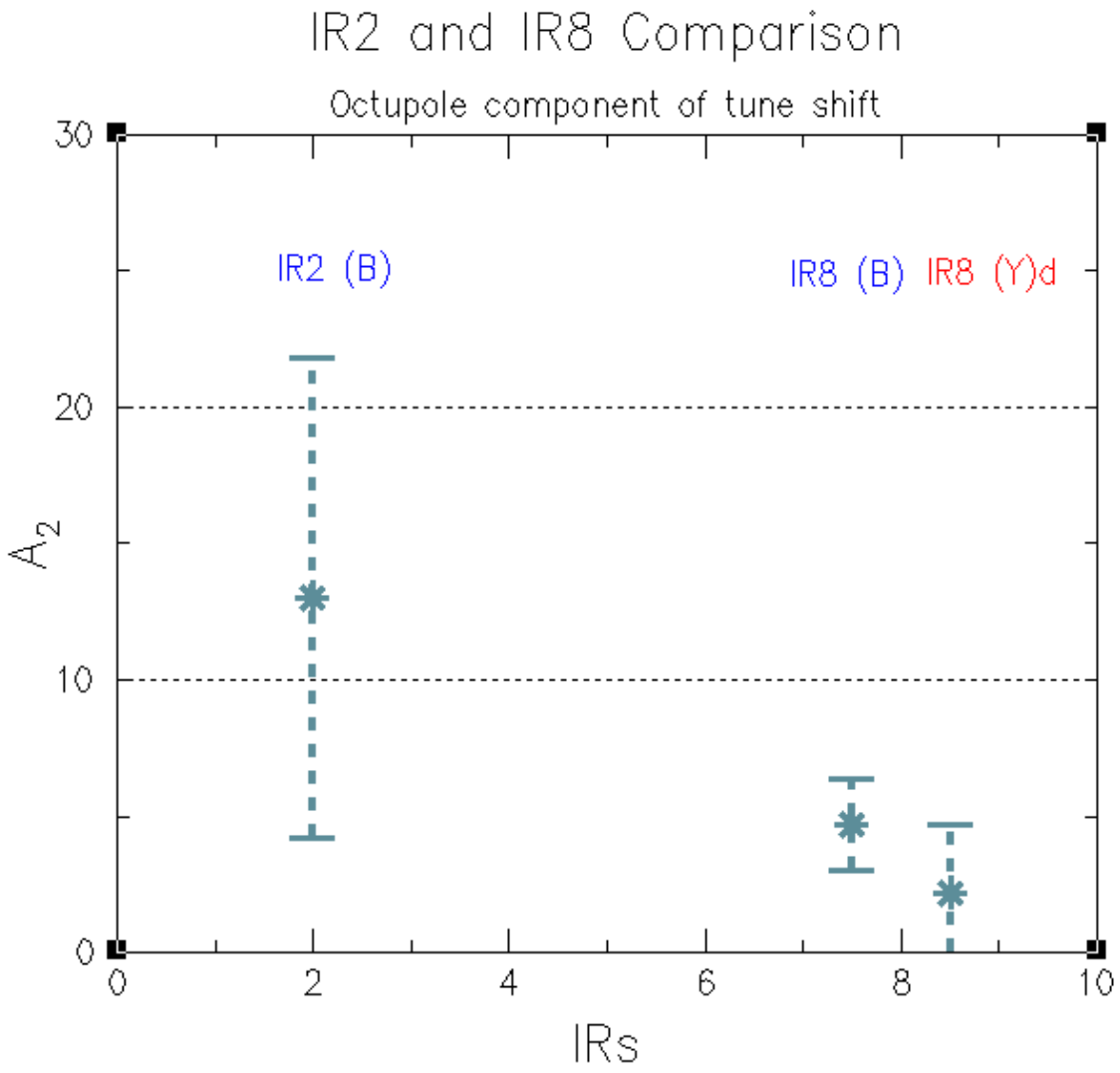
This example is with a strong decapole corrector powered.



IR Local Correction

- Done This Run:
  - Calibration of the nonlinear correctors
  - Factor 3 disagreement from predicted tune shift
  - IR8 data collected for different beta*
  - IR8 sextupole and octupole correction
    - Demonstrated successfully in Yellow
  - IR2 data collected
    - Not completely; Logged data lost


ir2_8.xmgr
File Data Plot Options Help
G0: X, Y = [4.98038, 0.320016]
Draw
AutoT
AutoO
ZX ZY
AX AY
PZ Pu
Po Cy
SD:1
CW:0
Exit
IR2 and IR8 comparison
Sextupole component of tune shift
IR2 (B)
IR8 (B)
IR8 (Y)
A1
IRs
0
0.1
0.2
0.3
0.4
0.5
0
2
4
6
8
10
coyote.pbn.bnl.gov, :0.0, Wed Mar 13 09:05:20 2002, ir2_8.xmgr


IR2 and IR8 Comparison
Octupole component of tune shift
IR2 (B)
IR8 (B)
IR8 (Y)d
30
20
10
0
A_2
0
2
4
6
8
10
IRs

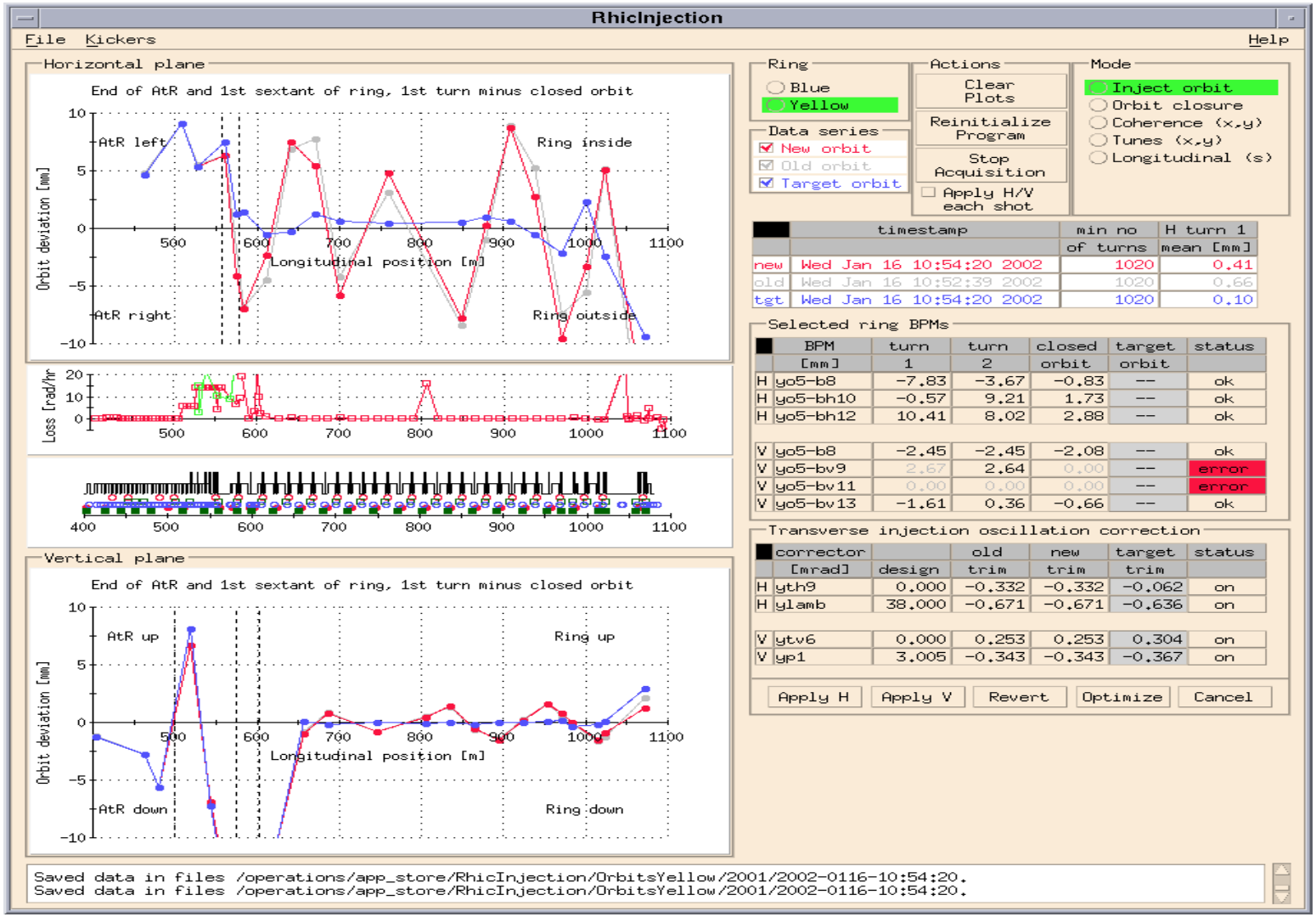
Resonance Correction

- 0.2 and 0.25 resonances are strongest we have around
- Issues:
  - Injection efficiency.
  - Losses on the ramp
  - Lifetime at the flattop.
- Done during the proton run at injection
- Method:
  - Create injection error using ATR steering dipoles
  - Observe the resonance lines on multiturn data on Tunemeter or RhicInjection display
  - Use the avalilable correctors to eliminate the line

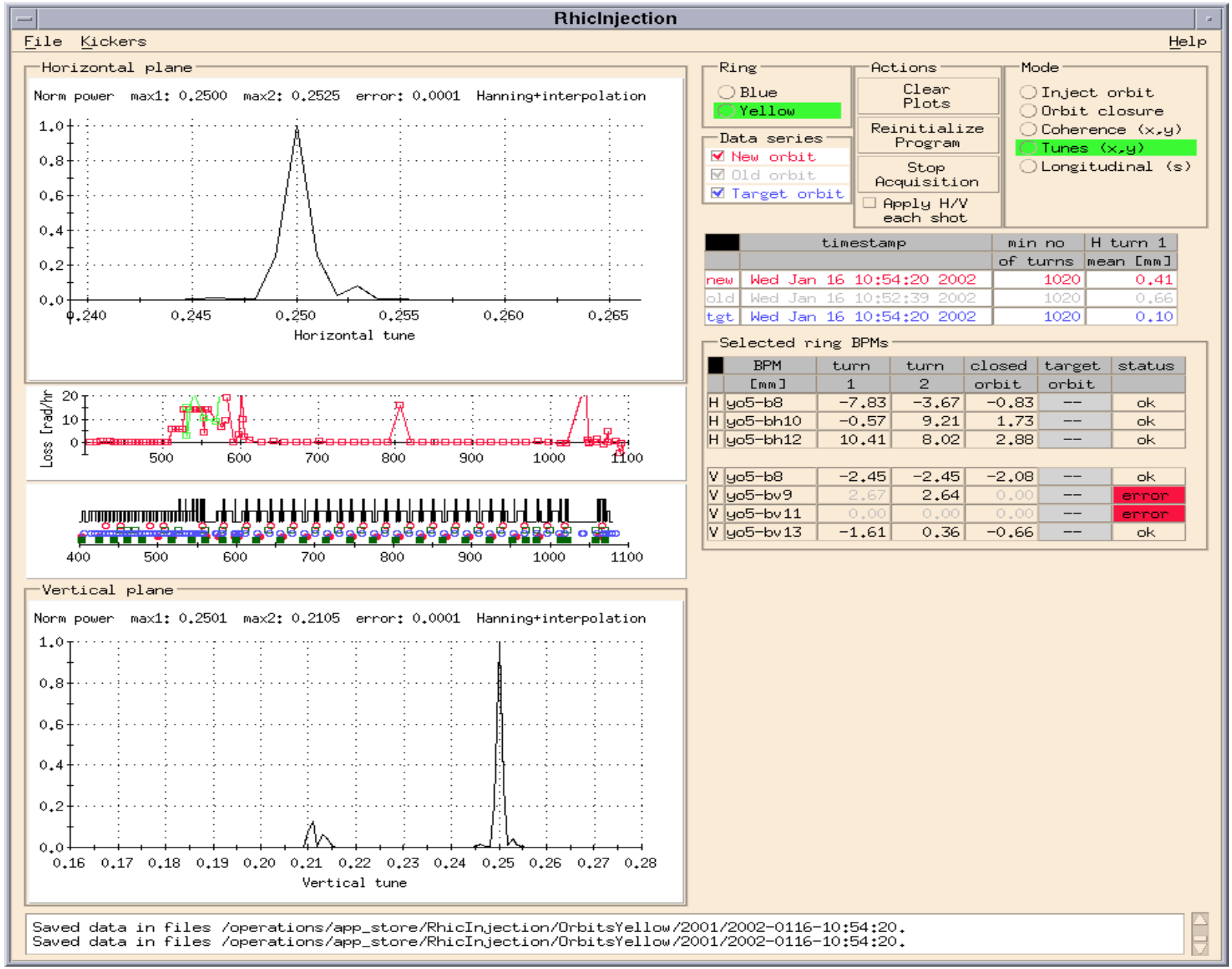
Resonance Correction

- IR correctors at IR6,8 were used for the correction
  - Decapoles for 0.2 / octupoles for 0.25 corection
  - The correctors were grouped in two families according to the phase relations to provide the orthogonal knobs for the correction
- The correctors were up to 40% of their limit strength at injection.
  - Not enough strength to correct at flattop

Horizontal injection error (red line) was used to put some beam into resonance islands

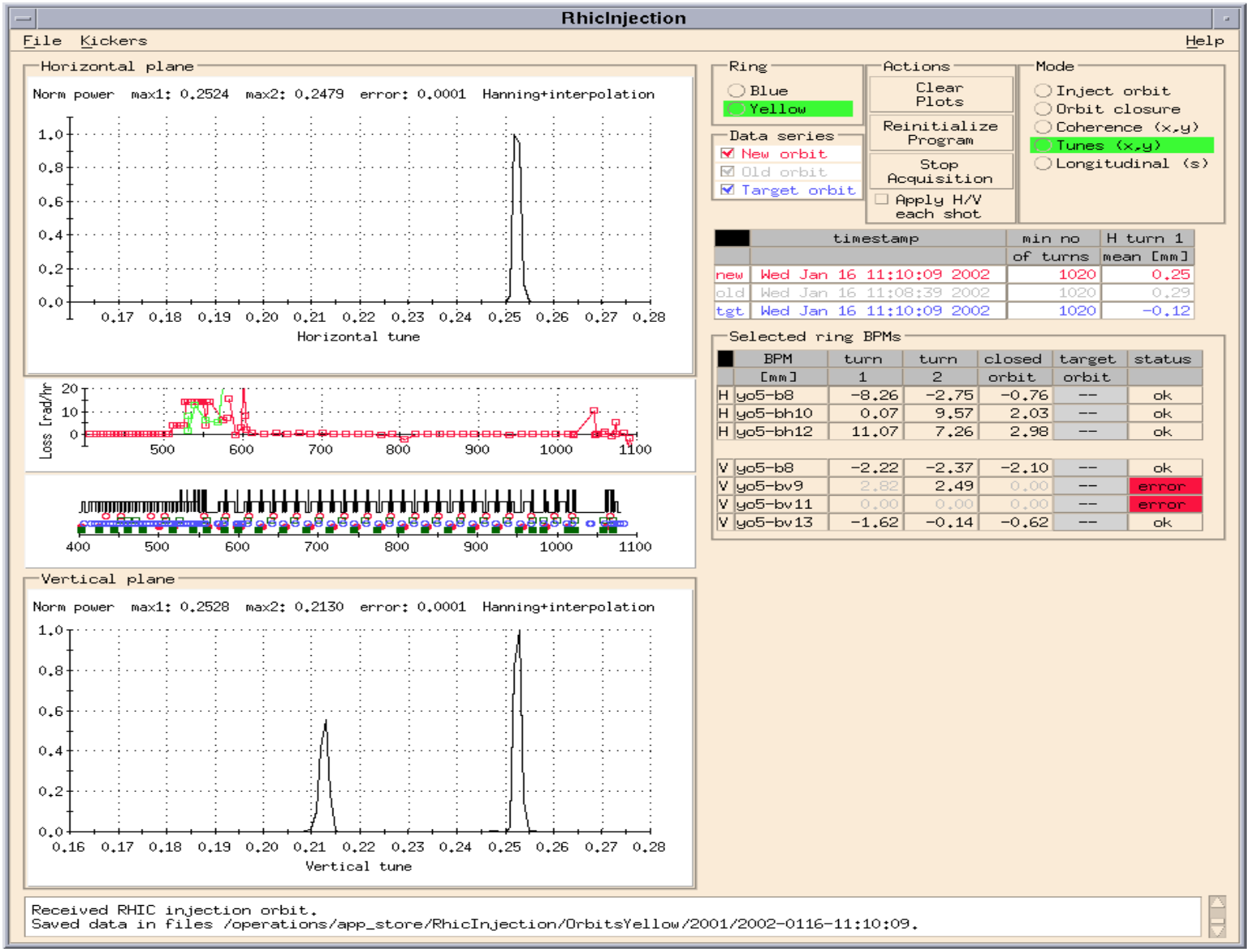


The strong resonance signal at 0.25
Smaller peak (at 0.253) corresponds to Qx



The resonance signal was eliminated using IR octupoles

Only Qx signal left.



Resonance Correction

- To Do:
  - The data analysis for 0.2,0.25 resonances taken during beam studies. Resonance strength at injection.
  - Comparison with the prediction from magnet measurements.
  - The correction scheme for each resonance compensation. Power supply load evaluation and optimization.
  - The local versus global correction consideration.
  - Is correction at flattop possible?